

N-channel 80 V, 0.0017 Ω typ., 180 A, STripFET™ F7
Power MOSFETs in H²PAK-2, H²PAK-6 and TO-220 packages

Datasheet – production data

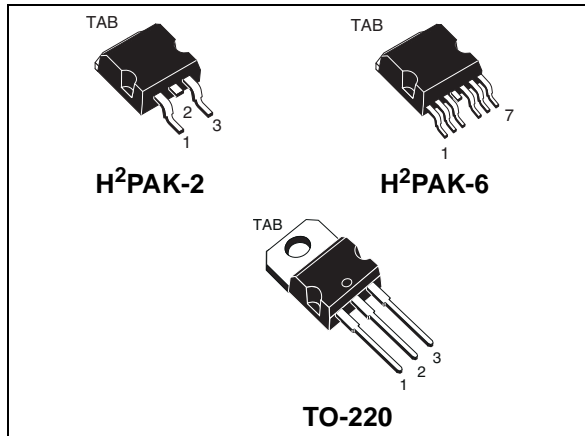
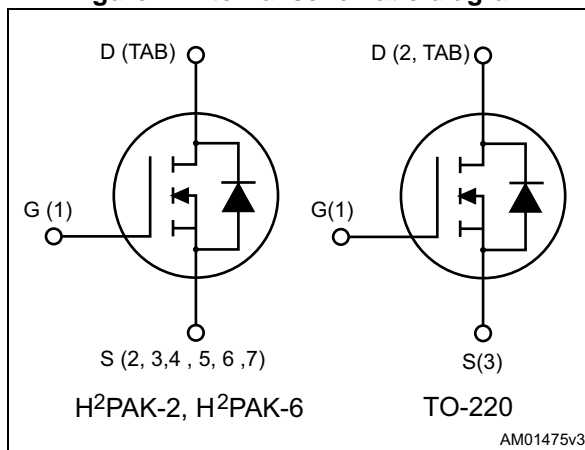


Figure 1. Internal schematic diagram



Features

Order codes	V _{DS}	R _{DS(on)} max	I _D
STH270N8F7-2	80 V	0.0021 Ω	180 A
STH270N8F7-6			
STP270N8F7		0.0025 Ω	

- Among the lowest R_{DS(on)} on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

These N-channel Power MOSFETs utilize STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STH270N8F7-2	270N8F7	H ² PAK-2	Tape and reel
STH270N8F7-6		H ² PAK-6	
STP270N8F7		TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	80	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous)	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	180	A
$I_{DM}^{(2)}$	Drain current (pulsed)	720	A
$P_{TOT}^{(3)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	315	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	1.16	J
T_J	Operating junction temperature	-55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature		$^\circ\text{C}$

1. Limited by package
2. Pulse width limited by safe operating area
3. This value is rated according to R_{thj-c}
4. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_d = 65\text{ A}$, $V_{dd} = 50\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		H ² PAK-2, H ² PAK-6	TO-220	
$R_{thj-case}$	Thermal resistance junction-case	0.48		$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35		$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max		62.5	$^\circ\text{C/W}$

1. When mounted on FR-4 board of 1 inch², 2oz Cu

2 Electrical characteristics

($T_{CASE}=25\text{ °C}$ unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS}=0$)	$I_D = 250\text{ }\mu\text{A}$	80			V
I_{DSS}	Zero gate voltage drain current ($V_{GS}=0$)	$V_{DS} = 80\text{ V}$ $V_{DS} = 80\text{ V}; T_C=125\text{ °C}$			10 100	μA μA
I_{GSS}	Gate body leakage current ($V_{DS}=0$)	$V_{GS} = +20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS}=V_{GS}, I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	For H ² PAK-2, H ² PAK-6: $V_{GS} = 10\text{ V}, I_D = 90\text{ A}$		0.0017	0.0021	Ω
		For TO-220: $V_{GS} = 10\text{ V}, I_D = 90\text{ A}$		0.0021	0.0025	

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS}=50\text{ V}, f=1\text{ MHz},$ $V_{GS}=0$	-	13600	-	pF
C_{oss}	Output capacitance		-	2050	-	pF
C_{rss}	Reverse transfer capacitance		-	236	-	pF
Q_g	Total gate charge	$V_{DD}=40\text{ V}, I_D = 180\text{ A}$ $V_{GS} = 10\text{ V}$ <i>Figure 19</i>	-	193	-	nC
Q_{gs}	Gate-source charge		-	96	-	nC
Q_{gd}	Gate-drain charge		-	46	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=40\text{ V}, I_D = 90\text{ A},$ $R_G=4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ <i>Figure 18</i>	-	56	-	ns
t_r	Rise time		-	180	-	ns
$t_{d(off)}$	Turn-off delay time		-	98	-	ns
t_f	Fall time		-	42	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		180	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		720	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 90 \text{ A}$, $V_{GS} = 0$	-		1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 180 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 64 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$	-	78		ns
Q_{rr}	Reverse recovery charge		-	182		nC
I_{RRM}	Reverse recovery current		-	4.7		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 μs , duty cycle 1.5%

3 Electrical characteristics (curves)

Figure 2. Safe operating area for H²PAK-2 and H²PAK-6

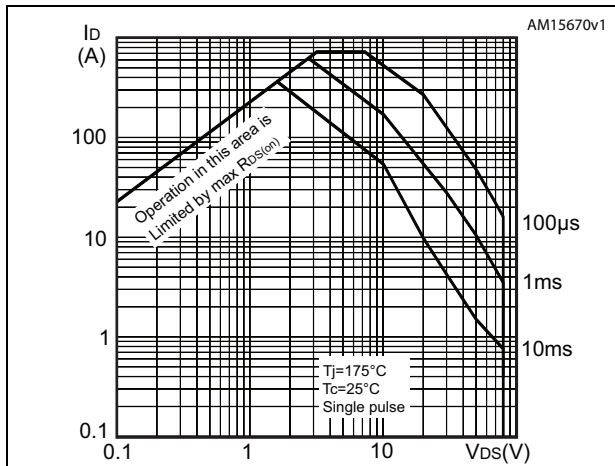


Figure 3. Safe operating area for TO-220

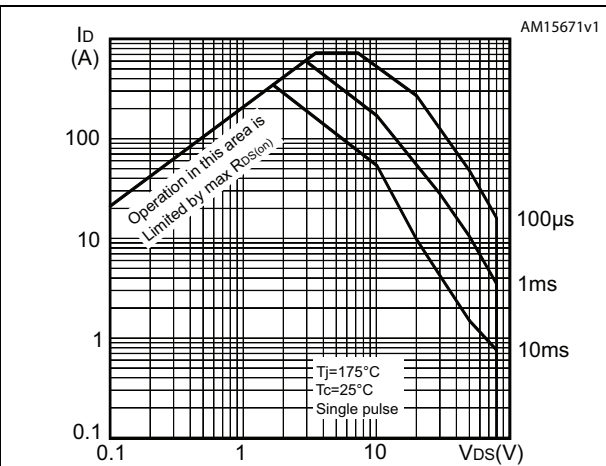


Figure 4. Thermal impedance

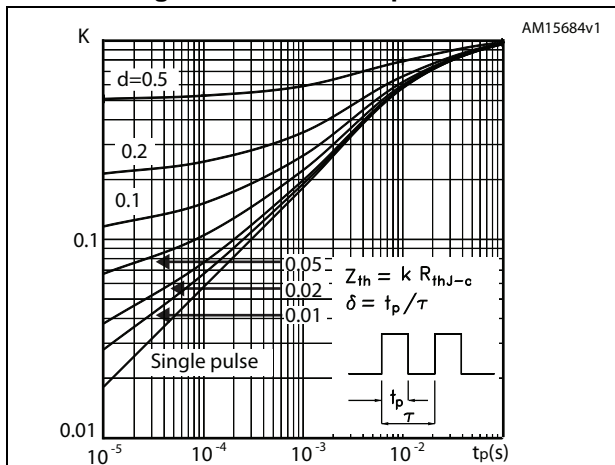


Figure 5. Gate charge vs gate-source voltage

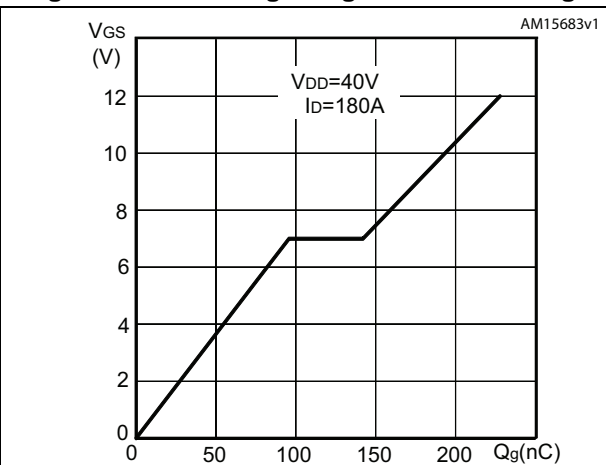


Figure 6. Output characteristics for TO-220

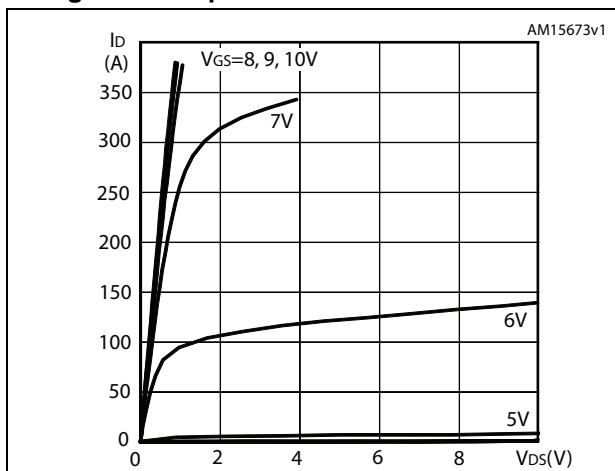


Figure 7. Transfer characteristics for TO-220

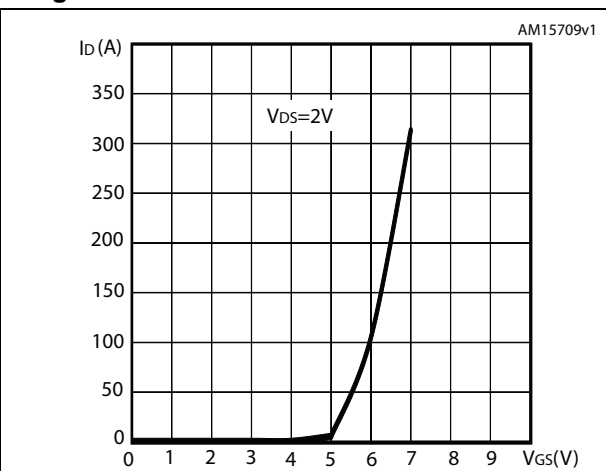


Figure 8. Output characteristics for H²PAK-2 and H²PAK-6

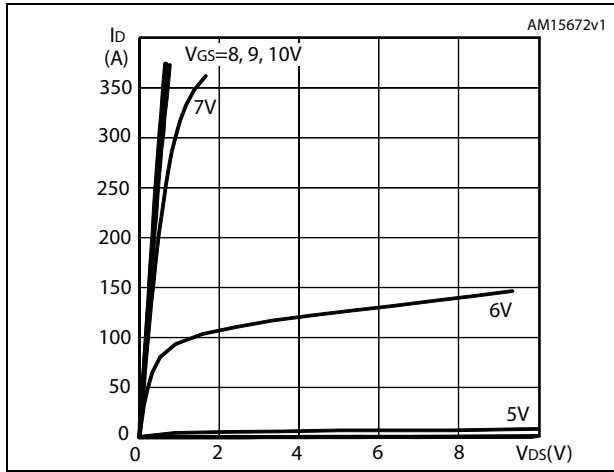


Figure 9. Transfer characteristics for H²PAK-2 and H²PAK-6

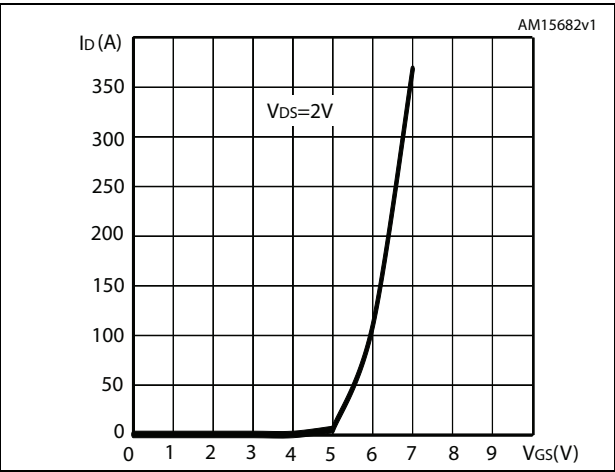


Figure 10. Normalized V_{(BR)DSS} vs temperature

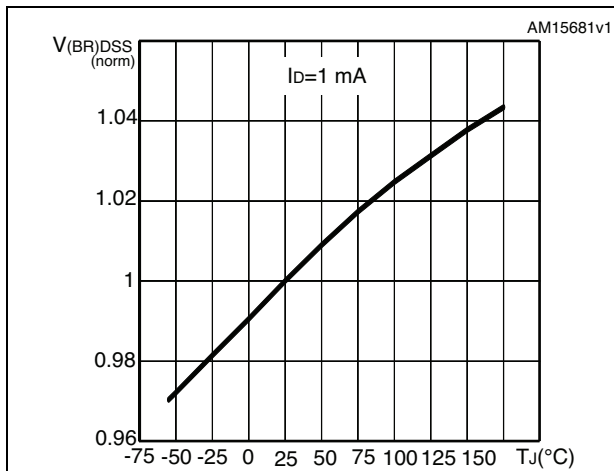


Figure 11. Static drain-source on-resistance for H²PAK-2 and H²PAK-6

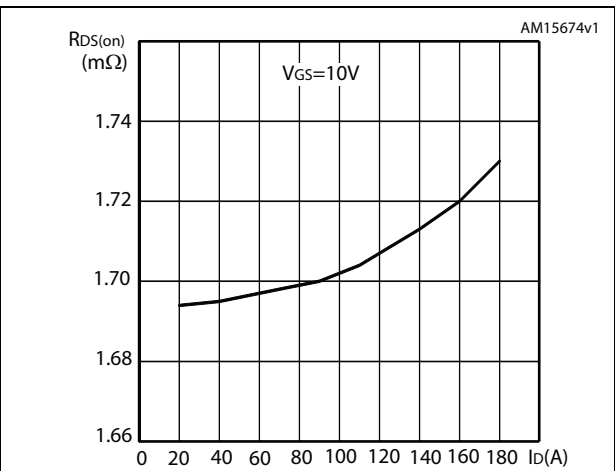


Figure 12. Static drain-source on-resistance for TO-220

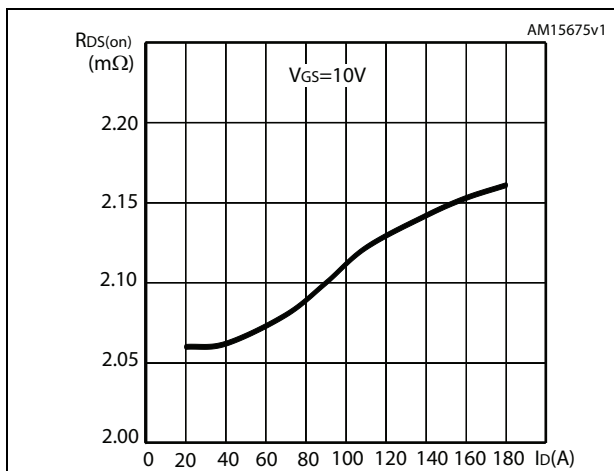


Figure 13. Capacitance variations

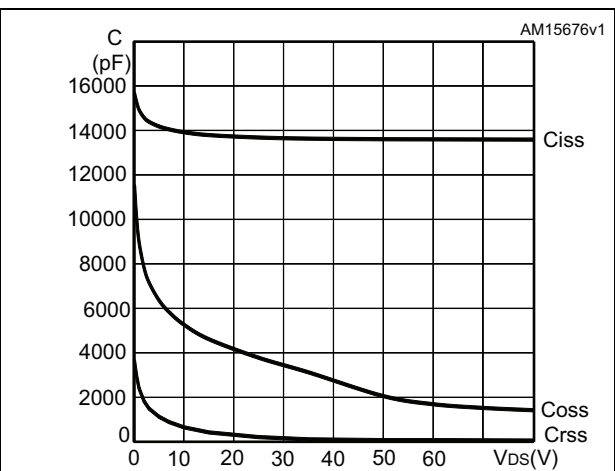


Figure 14. Source-drain diode forward characteristics

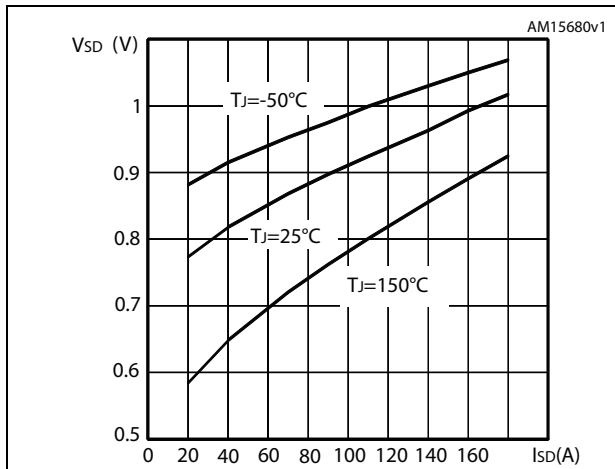


Figure 15. Normalized gate threshold voltage vs temperature

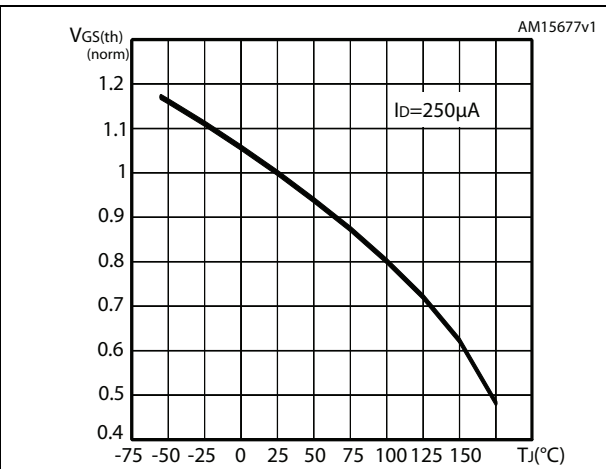


Figure 16. Normalized on-resistance vs temperature for H²PAK-2 and H²PAK-6

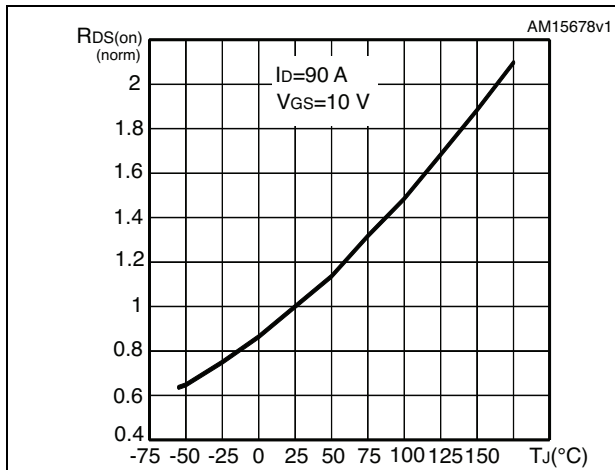
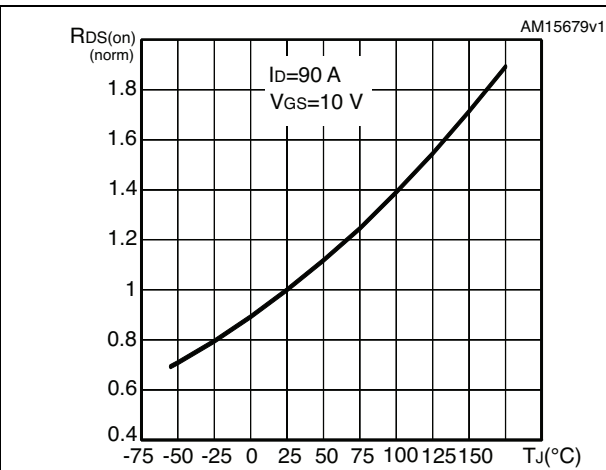
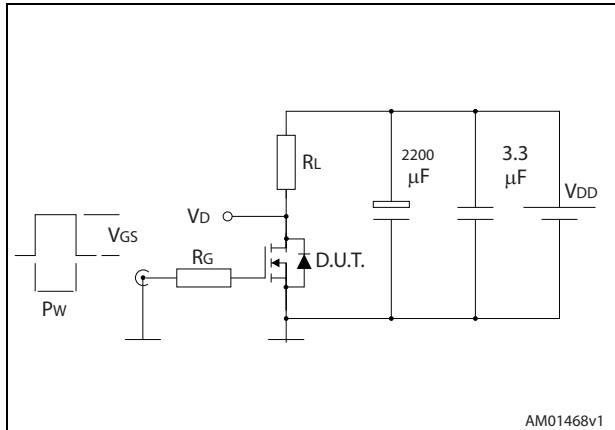


Figure 17. Normalized on-resistance vs temperature for TO-220



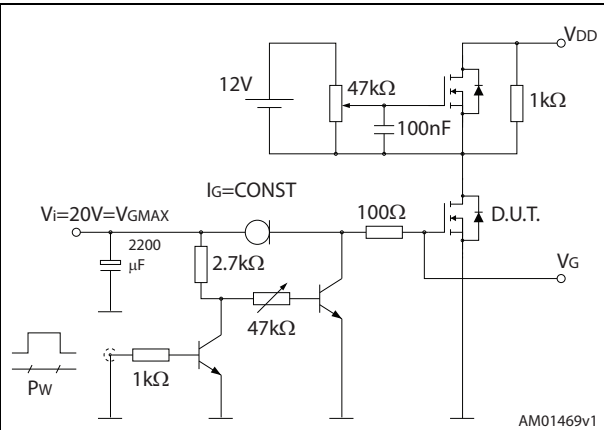
4 Test circuits

Figure 18. Switching times test circuit for resistive load



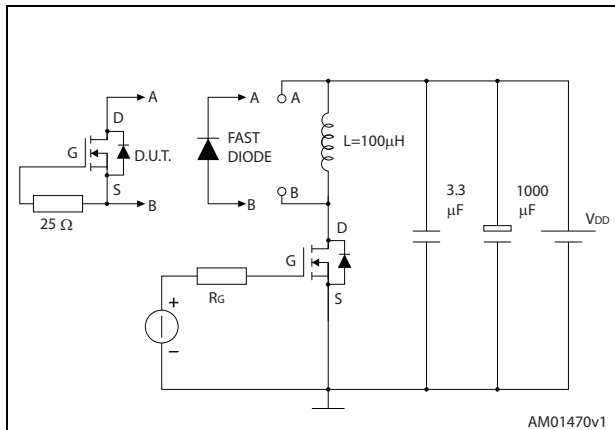
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Figure 19. Gate charge test circuit



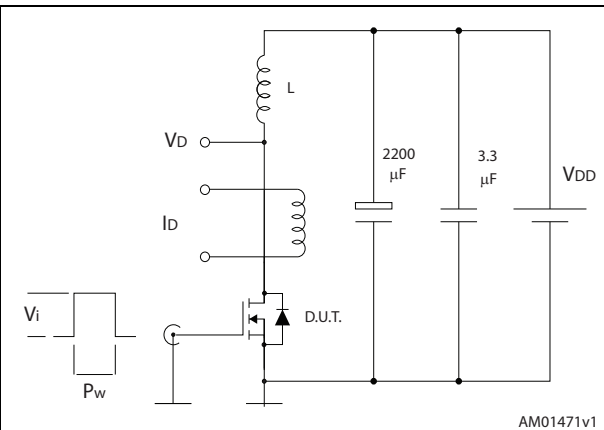
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Figure 20. Test circuit for inductive load switching and diode recovery times



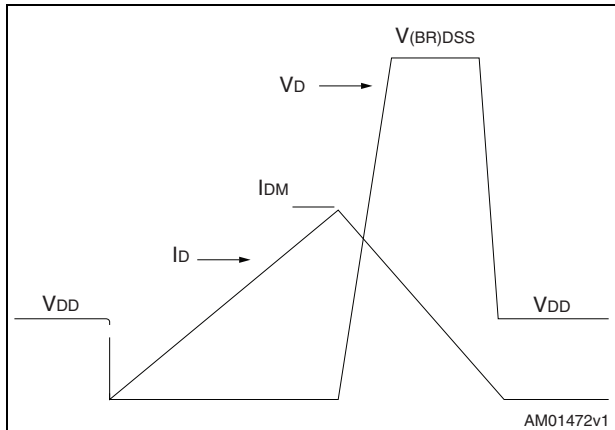
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Figure 21. Unclamped inductive load test circuit



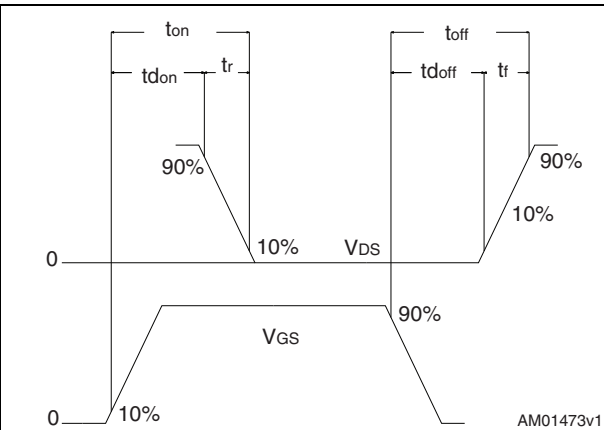
AM01471v1

Figure 22. Unclamped inductive waveform



AM01472v1

Figure 23. Switching time waveform



AM01473v1

5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

5.1 H²PAK-2 package information

Figure 24. H²PAK-2 package information

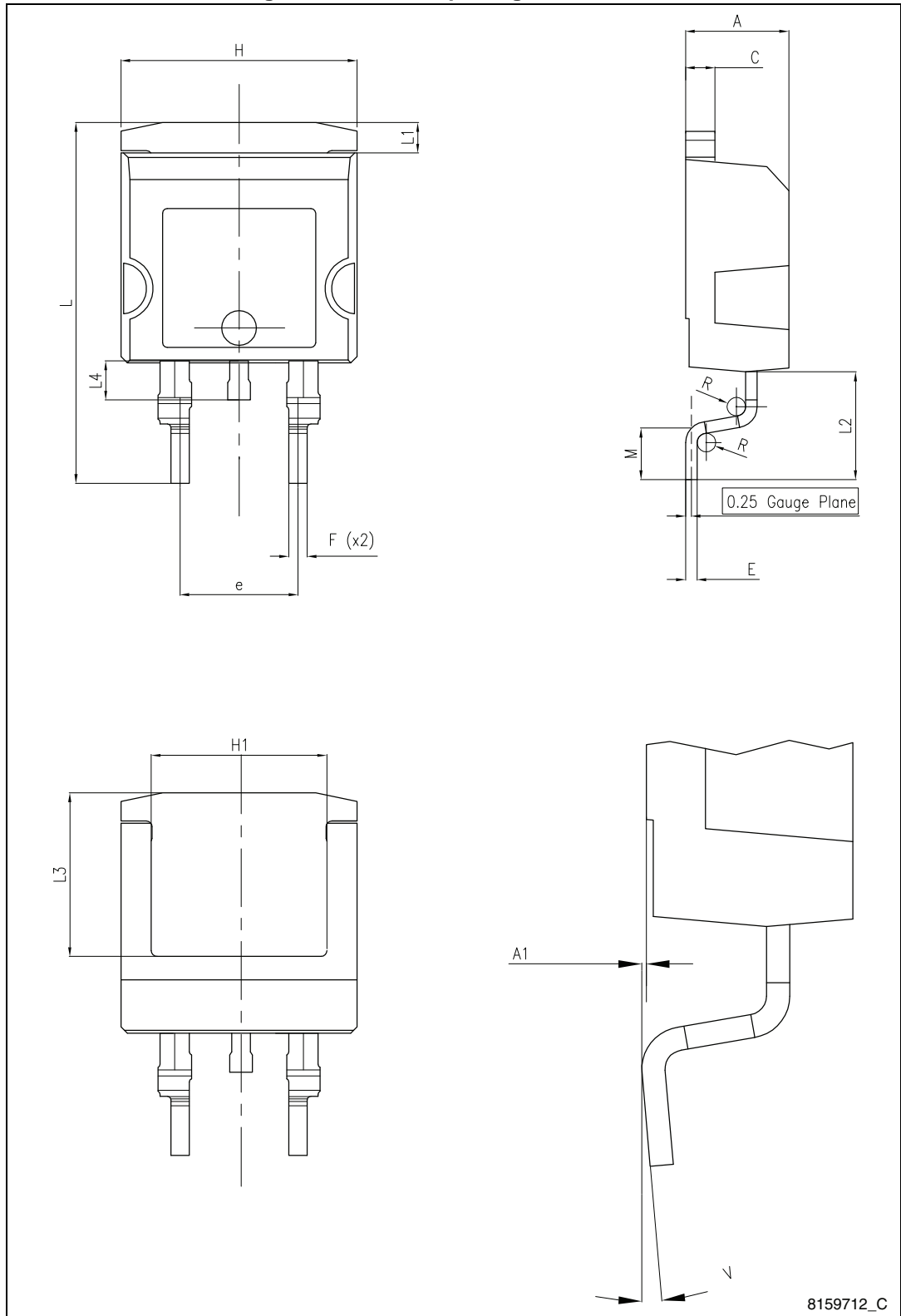
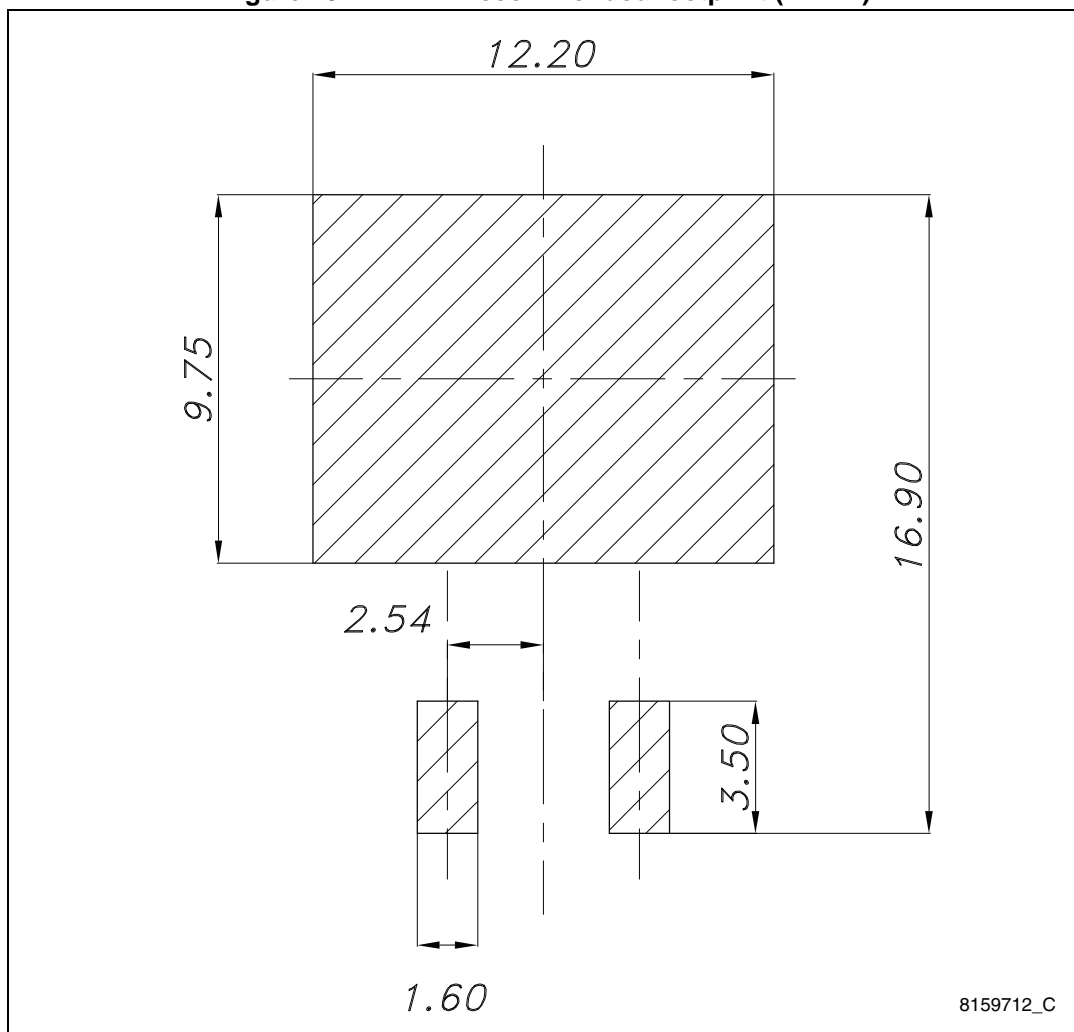


Table 8. H²PAK-2 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
H	10.00		10.40
H1	7.40		7.80
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.5		1.7
M	2.6		2.9
R	0.20		0.60
V	0°		8°

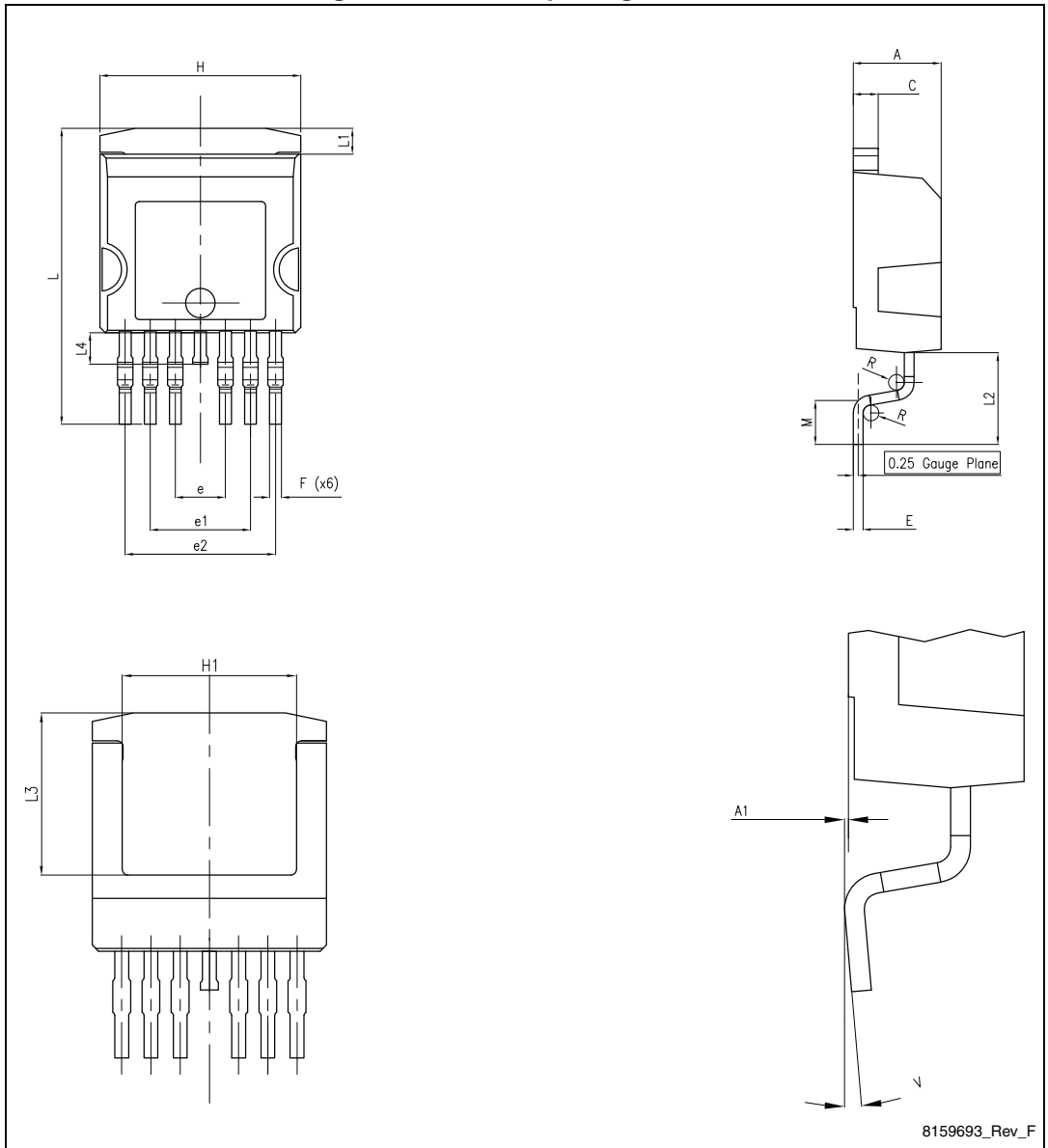
Figure 25. H²PAK-2 recommended footprint (in mm)



8159712_C

5.2 H²PAK-6 package information

Figure 26. H²PAK-6 package outline

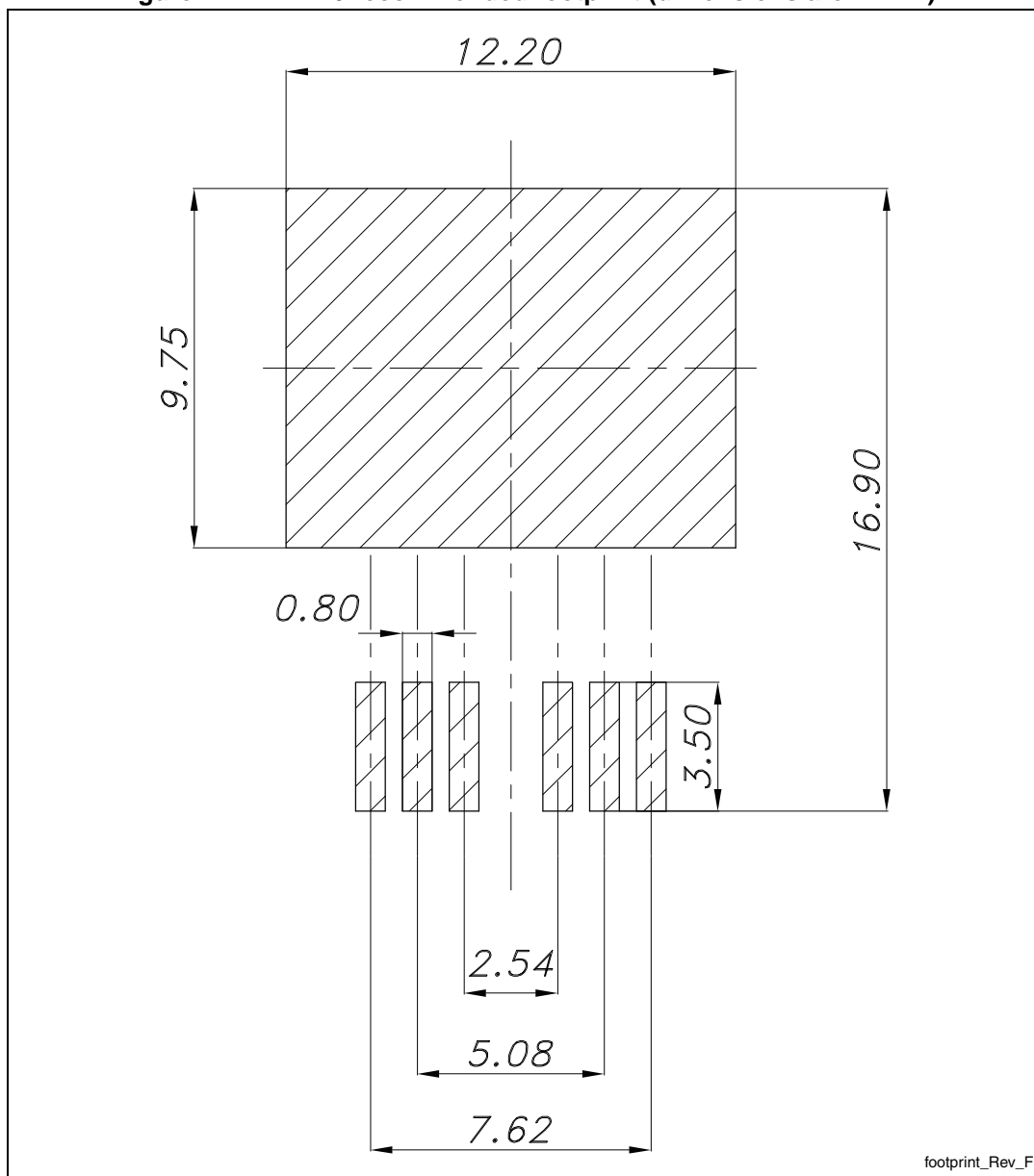


8159693_Rev_F

Table 9. H²PAK-6 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	2.34		2.74
e1	4.88		5.28
e2	7.42		7.82
E	0.45		0.60
F	0.50		0.70
H	10.00		10.40
H1	7.40		7.80
L	14.75		15.25
L1	1.27		1.40
L2	4.35		4.95
L3	6.85		7.25
L4	1.5		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 27. H²PAK-6 recommended footprint (dimensions are in mm)



5.3 TO-220 type A package information

Figure 28. TO-220 type A package outline

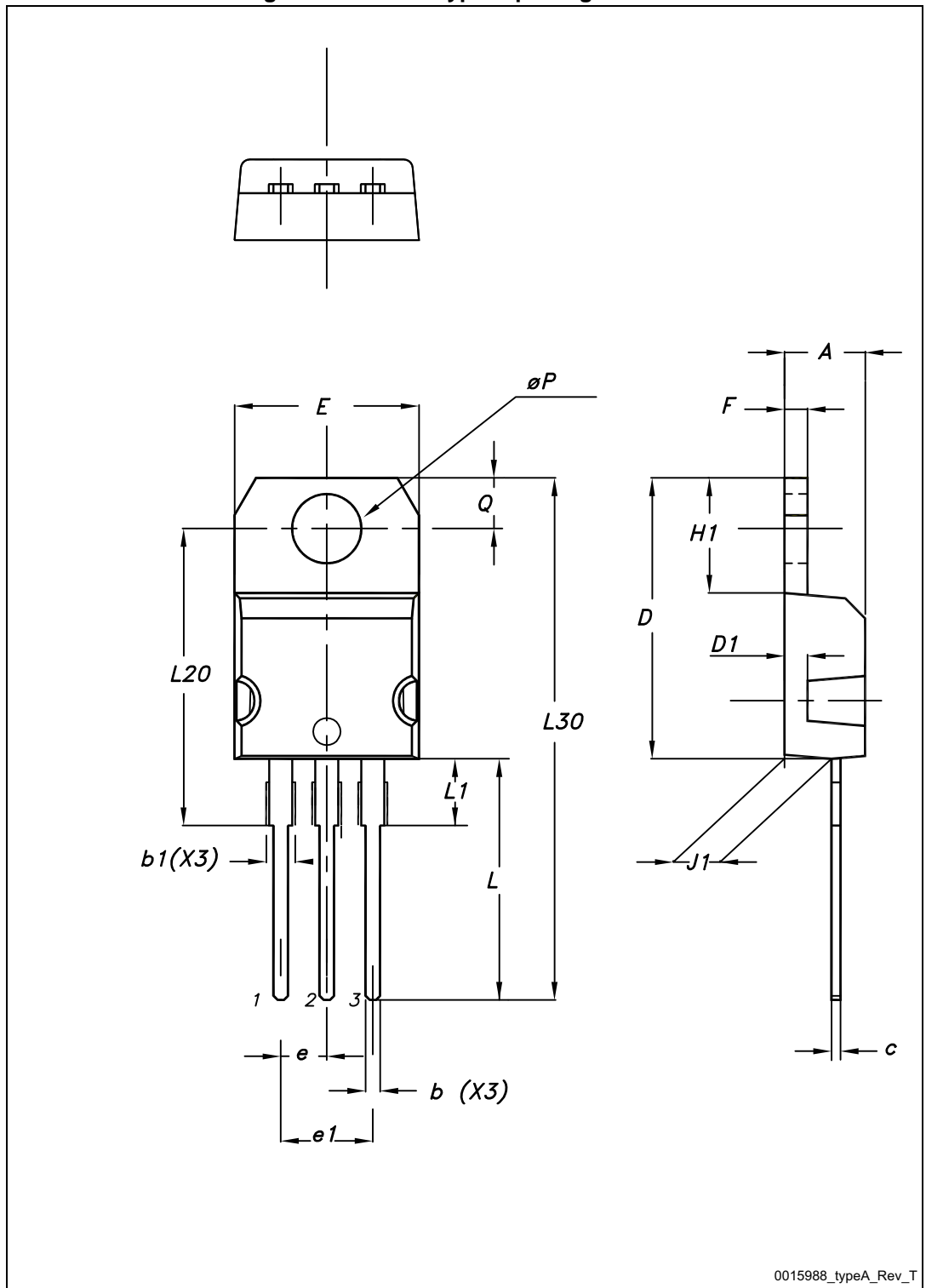


Table 10. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

6 Packing information

Figure 29. Tape

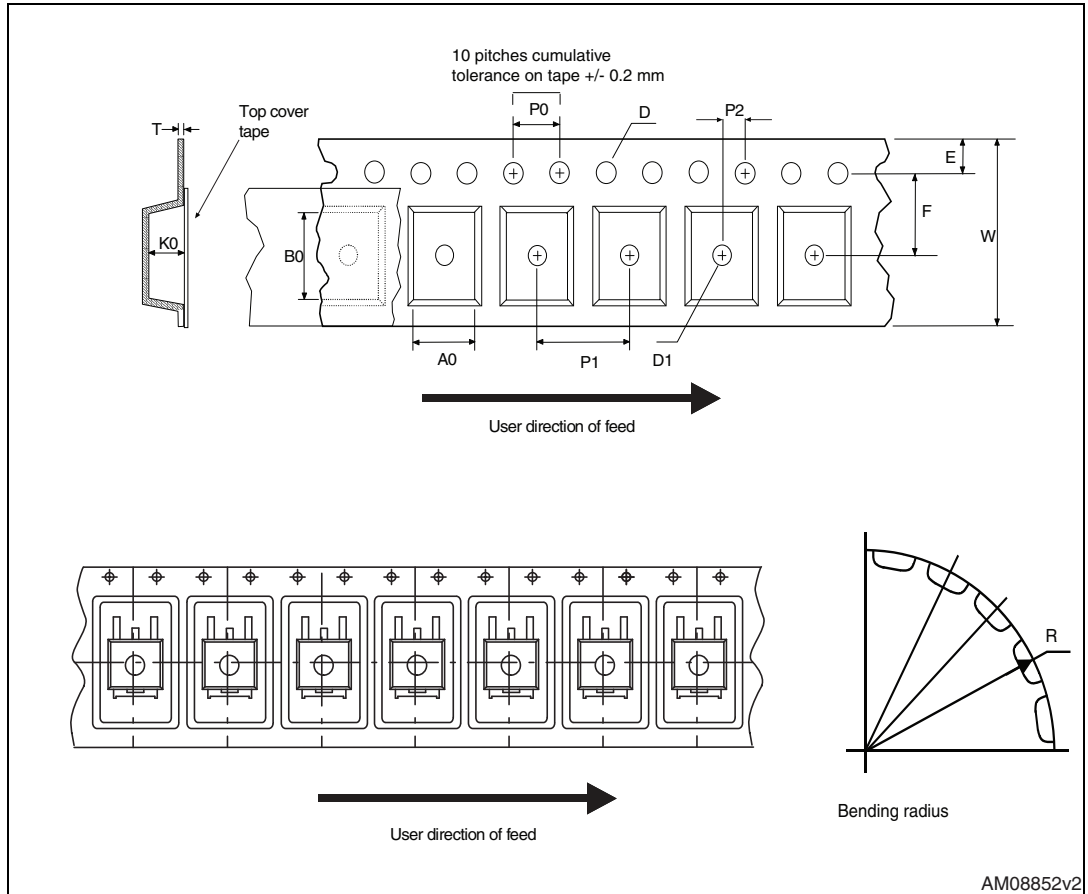


Figure 30. Reel

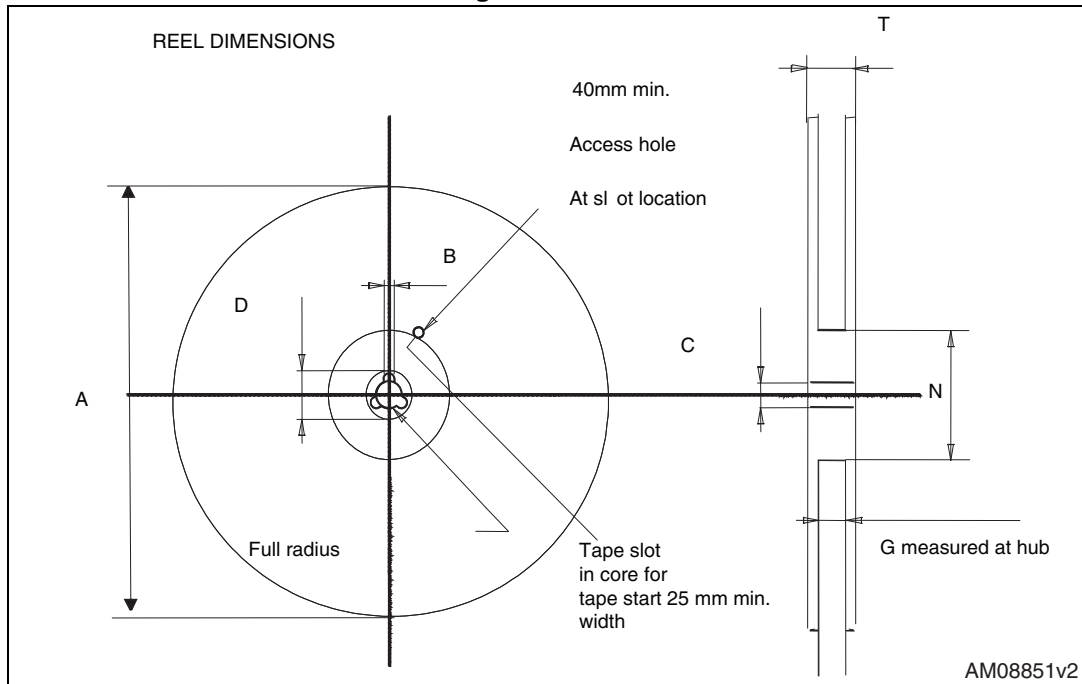


Table 11. H²PAK-2 and H²PAK-6 tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

7 Revision history

Table 12. Document revision history

Date	Revision	Changes
03-Dec-2012	1	First release.
09-Apr-2013	2	<ul style="list-style-type: none"> - Modified: $R_{DS(on)}$ max values on Features table, I_{DSS}, I_{GSS} values on Table 4, $R_{DS(on)}$ value for H²PAK-2, the entire typical values on Table 5 and 6, V_{SD} test conditions and max values, T_{RR}, Q_{RR}, I_{RRM} typical values on Table 7 - Inserted: Section 3: Electrical characteristics (curves) - Document status promoted to preliminary data to production data - Added: H²PAK-6 package - Minor text changes
11-Oct-2013	3	<ul style="list-style-type: none"> - Modified: C_{rSS} typical value in Table 5 - Updated: Section 5: Package information - Updated: Figure 18, 19, 20 and 21 - Minor text changes
14-May-2015	4	<ul style="list-style-type: none"> - Updated title, features and description in cover page. - Minor text changes

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